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NATIONAL DAM SAFETY PROGRAM. LEE HALL RESERVOIR (ID NUMBER VA-7--ETC(U)
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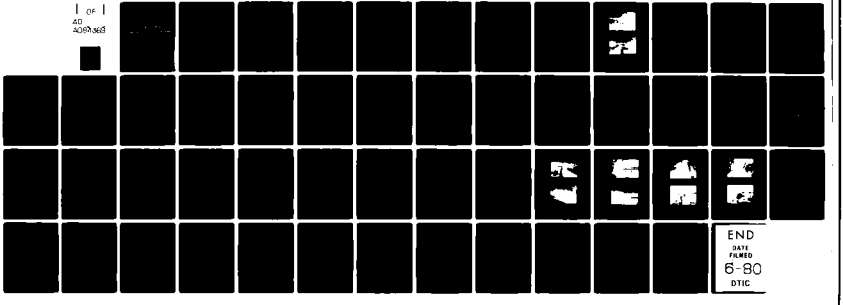
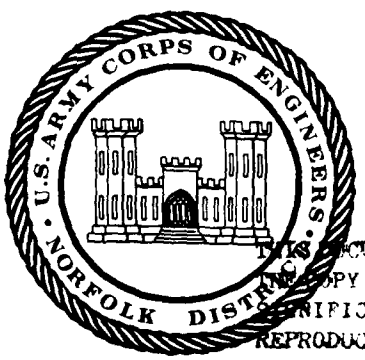


JAMES RIVER BASIN

LEVEL II

Name Of Dam: LEE HALL RESERVOIR
Location: CITY OF NEWPORT NEWS
Inventory Number: VA. 70001

PHASE I INSPECTION REPORT
NATIONAL DAM SAFTY PROGRAM



PREPARED BY
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

JANUARY 1980

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirement of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

JAMES RIVER BASIN

NAME OF DAM: LEE HALL RESERVOIR
LOCATION: CITY OF NEWPORT NEWS, VIRGINIA
INVENTORY NUMBER: VA 70001

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

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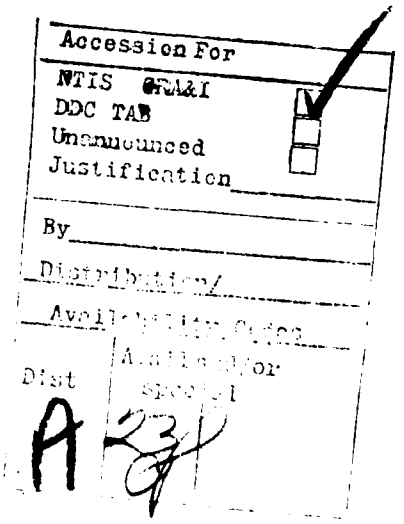


PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

BRIEF ASSESSMENT OF DAM

Name of Dam:	Lee Hall Reservoir
State:	Virginia
Location:	City of Newport News
USGS Quad Sheet:	Yorktown
Stream:	Headwaters of Warwick River
Date of Inspection:	28 November 1979

The Lee Hall Reservoir is an earthfill structure about 2400 feet long and 21 feet high. The dam is owned by the City of Newport News, Virginia. The dam is classified as an intermediate size with a significant hazard classification. The spillway is comprised of a steel bascule gate and the emergency spillway, approximately one foot higher than the gated spillway, is a drop-inlet. The reservoir is used for water supply and recreation.

Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) appropriate for this dam is 1/2 the Probable Maximum Flood (1/2 PMF). The spillways will pass 57 percent of the PMF without overtopping the dam; therefore, the combined spillway capacity is adjudged adequate.

The visual inspection revealed no apparent problems and there are no immediate needs for remedial measures. There is a regular maintenance operation program and adequate warning system. It is recommended that the maintenance items listed in Section 7.2 be accomplished as part of the regular maintenance operation program within the next 12 months.

Submitted By:

Original signed by:
JAMES A. WALSH

JAMES A. WALSH, P. E.
Chief, Design Branch

Approved:

Original signed by:
Douglas L. Haller

DOUGLAS L. HALLER
Colonel Corps of Engineers
District Engineer

Date: FEB 8

Recommended By

Original signed by:
Ronald G. Vann

JACK G. STARR
Chief, Engineering Division

OVERALL VIEWS OF DAM
28 NOVEMBER 1979

SECTION 1

PROJECT INFORMATION

1.1 General:

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (Reference 1, Appendix IV). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: The Lee Hall Reservoir Dam is an earthen embankment about 2400 feet long and 21 feet high. The crest of the dam is at elevation 21.0 feet. Old Route 60, which is a concrete road topped with crushed gravel, traverses the entire length of the dam. The width and side slopes of the embankment vary considerably. The width ranges from 40 feet to 200 feet with a typical width of about 50 feet. The upstream slope ranges from a minimum 2.5H:1V two a maximum 4H:1V. The downstream slope is highly irregular due to a dumped fill used to buttress the embankment. The steepest downstream original slope is 2H:1V. There is no foundation drainage system and the embankment foundation is unknown.

A gated spillway with crest at elevation 11.5 and with a steel bascule gate 50 feet long and 6 feet high is located near the center of the dam. The normal pool is maintained at approximately 17.5 feet with the bascule gate in the closed position. A stilling basin with 11 dissipater concrete blocks is located below the gate to help reduce flow velocities discharging downstream.

A concrete lined drop-inlet emergency spillway is located 97 feet left of the bascule gate. The spillway crest is at elevation 18.6 with an effective crest length of 24 feet. A concrete bridge to the control house for the bascule gate crosses the spillway.

Three 36-inch sluice gates with invert elevations at elevation 0.0 are located in the lower portion of the emergency spillway. These gates can be used to drain the reservoir.

A Chesapeake & Ohio Railroad earthen embankment is located in the reservoir. The embankment functions as a dam and divides the reservoir into an upper and lower pool. The embankment is approximately 600 feet long and 17 feet high. The top of the embankment is 40 feet wide at an elevation of 36.0 feet msl. The side slopes are 2.5H:1.5V with no slope protection.

A concrete weir spillway is located in the reservoir above the railroad embankment. The crest of the spillway is 11 feet long and at elevation 21.0. A metal sheetpile curtain placed from the railroad embankment to the spillway separates two distinct pool levels. Two 3 feet by 6 feet sluice gates, with inverts at elevation 7.5, are used to pass water to the lower pool during normal operating conditions. When the water level rises above elevation 21.0, water automatically flows over the spillway. Flows over the sheet pile curtain will occur when the pool level reaches elevation 21.5.

1.2.2 Location: The Lee Hall Reservoir Dam is located in the City of Newport News, Virginia at the headwaters of the Warwick River, about two thirds of a mile north of Fort Eustis Military Reservation.

1.2.3 Size Classification: The dam is classified as an intermediate size structure by maximum storage capacity.

1.2.4 Hazard Classification: The dam is located upstream of Route 60 and about 6 homes, which could sustain some damage during a failure of the dam; therefore, a significiant hazard classification is given for this structure according to guidelines contained in Section 2.1.2. of Reference 1, Appendix IV. The hazard classification used to categorize dams is a function of location only and has nothing to do with their stability or probability of failure.

1.2.5 Ownership: City of Newport News, Virginia

1.2.6 Purpose: Water supply and recreation

1.2.7 Design and Construction History: The designer is unknown. The dam was originally constructed in 1893 to 12 feet in height. In 1900 and 1913 the dam was raised to 14.25 feet and 17.5 feet, respectively, to increase the storage volume. The dam was raised to its present height when old Route 60 was constructed in the 1920's. A steel bascule gate was placed in the embankment in 1968 to increase the spillway capacity. Also, at this time portions of the downstream slope were built up with dumped random fill taken from the nearby construction of the filtration plant.

1.2.8 Normal Operational Procedures: The pump station, located to the left of the dam, can pump a maximum 44 million gallons of water per day to the Lee Hall Filtration Plant. The operation of the dam is automatic, passing excessive flows over the bascule gate as the reservoir pool rises above elevation 17.5. As the pool rises above elevation 18.0 the gate automatically begins to open, opening fully when the reservoir pool level reaches 18.5. Flows through the emergency spillway will occur when the reservoir rises above elevation 18.6.

1.3 Pertinent Data:

1.3.1 Drainage area: The dam controls a drainage area of 15.7 square miles, 13.72 of which are above the Chesapeake and Ohio Railroad embankment in the reservoir.

1.3.2 Discharge at Dam Site:

The dam was overtopped by 2-3 inches in 3 places after a two-day storm beginning on June 2, 1963.

Pool level at top of dam

Bascule gate (fully open)	5344 cfs
Emergency spillway	603 cfs

1.3.3 Dam and Railroad Embankment Data: Pertinent data on the dam and railroad embankment are shown in the following tables:

Table 1.1 RESERVOIR DATA FOR DAM AND RAILROAD EMBANKMENT

DAM DATA

Item	Elevation feet msl	Reservoir Capacity Area, acres	Acre, feet	Watershed, inches	Length miles 1/
Top of Dam	21.0	115	945	8.9	.25
Emergency Spillway Crest	18.6	86	710	6.7	.25
Top of Bascule Gate (normal pool)	17.5	71	620	5.9	.25
Bascule gate crest	11.5	35	300	2.8	.25
Streambed at Downsteam Toe of Dam	0.0±	--	--	--	--

1/ Upper limit of reservoir is C&O Railroad embankment.

RAILROAD EMBANKMENT DATA

Item	Elevation feet msl	Reservoir Capacity Area, acres	Acre, feet	Watershed, inches	Length miles
Top of Embankment	36.0	1700	21100	28.8	4.6
Normal Pool	20.0	440	2900	4.0	3.7
Streambed at Downsteam Toe of Embankment	2.0±				

SECTION 2
ENGINEERING DATA

2.1 Design: Design data were provided by the owners. The data reviewed included the following:

a. Complete 1965 design drawings showing a non-detailed site plan of the dam, and plans and cross sectional views of the gated spillway, Appendix I, Plates I thru IV.

b. Limited 1912 design drawings showing plan and cross sectional views of the emergency spillway, Appendix I, Plates V & VI.

c. Limited undated design drawing showing plan and cross sectional views of the principal spillway through the railroad embankment located in the reservoir, Appendix I, Plate VII.

These data are very limited. There were no other drawings pertinent to the dam. However, Plates II and III do not effect the actual field conditions noted during the inspection. The concrete bridge shown on the noted plates is not in place, and an existing 42-inch diameter above ground waterline, spanning the gated and emergency spillway, is not shown. The capacity curve was considered unreliable, because it is not known how it was generated.

2.2 Construction: There are no known construction records available pertaining to the work performed in 1893, 1900, 1913, and for old Route 60 in the 1920's. There were no records available for the work performed in 1968.

2.3 Evaluation: Based on the available information, an adequate representation of the dam geometrics can be assumed. However, there is no design information. Therefore, there is insufficient information to evaluate the foundation condition and the embankment stability.

SECTION 3
VISUAL INSPECTION

3.1 Findings:

3.1.1 General: The results of the 28 November 1979 inspection are recorded in Appendix III. The Corps of Engineers inspection team returned 30 November 1979 to finish developing the sketch provided in Appendix I, Plate VIII. Mr. Robinson and Mr. Pezza returned 10 December 1979 to check over the Chesapeake & Ohio Railroad embankment located in the reservoir.

At the time of the initial inspection, the weather was sunny and clear. The temperature was 74° F and the ground conditions were dry. The pool elevation was approximately 17.3 MSL or about normal pool elevation. The tailwater elevation was about 0.4 MSL. There were small flows through leaks in the seals of the principal spillway. There are no known prior inspection reports.

3.1.2 Embankment: The embankment is in good condition. A plan view and cross sections are provided on Plate VIII. Overall views of the dam are provided at the beginning of the report.

There are no signs of surface cracks, unusual movement, sloughing, misalignment, riprap failures, or seepage. However, parts of the downstream embankment are built up with random fill as shown on Plate VIII. Also, portions of the dam are heavily vegetated as shown in Appendix II, Photo 2, and there are a few areas of erosion.

Downstream slopes are heavily vegetated with up to 18 inch diameter trees. The crest and upstream slopes are kept trimmed. A few small pines are located on the upstream crest between STA 16+00 and 21+00.

There are several gullies caused by surface runoff located on the downstream slope of the massive fill between STA 12+50 and 19+60. Also, there is a gully at the junction of the fill and original embankment at approximately STA 12+50.

The crest serves as a road. The road consists of a few inches of gravel overlying a 20-foot wide concrete pavement that once served as Route 60. In the area approaching the emergency spillway from each direction, the pavement slopes down and the embankment was built up to level the crest. The built up area was eroded away to the pavement during the 1963 storm. The pavement prevented further erosion. The eroded area was subsequently built up 3 to 4 feet to again level the crest. The pavement is presently at about the normal pool, but will be submerged during maximum pool. It is unknown why there was the 3 to 4-foot differential in elevation.

3.1.3 Gated Spillway: The spillway is fitted with a Bascule gate and is in good physical condition. The gate seals abutting the concrete wing wall have deteriorated. There is minor leakage. Also, the city is not satisfied with the past performance of the gate. The City can open the gate, but they are not sure the gate can be closed. Allis-Chalmers, the gate manufacturer, recently checked the gate, but the City is still dissatisfied with the performance of the gate. The approach channel is concrete lined, free from debris, and in good condition, except for a tree growing adjacent to the upstream right wingwall of the channel near the gate. The discharge channel is concrete lined, shallow, free from debris, and in good condition except for trees growing in downstream riprap. Photographs of the spillway are provided in Appendix II, Photos 1, 3, and 4.

3.1.4 Emergency Spillway: The spillway is of masonry cut stone construction and is in good condition. There is minor cracking in the crest of the spillway. An existing overhang will inhibit weir flows and should develop pressure flows. The approach channel is concrete lined and free of debris and is in good condition. The discharge channel is lined with cut stone masonry. There are five seeps and one boil located in the channel. The seeps are clearly visible. The boil is located on the centerline of the discharge apron about 5 feet from the downstream edge. A tree is growing out of the left wing wall. A concrete structural slab bridge inhibits flow through the weir. The slab has a longitudinal crack across the entire upstream face. There are three 36-inch diameter sluice gates. Two gates are operable and one gate, the left one, is partially operable. Photographs of the spillway are provided in Appendix II, Photos 5 thru 8.

3.1.5 Instrumentation: The only instrumentation are two VDH&T concrete right of way monuments located on the dam as shown on Plate VIII of Appendix I.

3.1.6 Reservoir Area: The surrounding terrain is relatively flat and heavily wooded. There are no signs of reservoir slope failures or shoreline erosion. There is no available information pertaining to sedimentation.

3.1.7 Downstream Channel: The area below the spillway outlets is tidal and flushed daily. The downstream area is generally a broad flat marshland. There are 6-8 homes in the flood plain less than one mile below the dam.

3.2 Evaluation: Overall, the dam appears to be in good condition. The inspection revealed certain preventive maintenance items which should be scheduled as part of an annual maintenance program. These are:

a. The trees located on the crest, on the downstream slope between Stations 0+00 and 12+50 noted on Plate VIII of Appendix I, and the tree located adjacent to the gate spillway approach channel should be cut down and have the root structures removed. The subsequent holes should be regraded, dressed with compacted fill, and seeded. The trees located in the discharge channels of both the gates and emergency spillways should be cut to the trunk. The removal of trees from the embankment and spillways is necessary to prevent further growth and reduce chances of piping.

b. The gully noted at STA 12+50 should be regraded, dressed with compacted fill, and seeded.

c. The cracks and seeps noted in the emergency spillway should be periodically monitored and repaired if further deterioration is evident and threatens the integrity of the structure.

d. The downstream slope of the embankment where it was built up adjacent to the emergency spillway should be monitored during maximum pools for seeps. The concrete pavement with the embankment could encourage cracking and possible piping.

e. The city should attempt to reinstate the operability of the bascale gate to their satisfaction.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures: The normal storage pool is elevation 17.5 at the dam site and 20.0 above the C&O Railroad embankment in the reservoir. Flows are regulated above the railroad embankment as needed to maintain the desired lower reservoir pool elevation. Two 3 feet by 6 feet sluice gates can be operated above the railroad embankment to regulate flows into the lower reservoir. As the reservoir below the railroad embankment rises, flows will discharge automatically over the bascule gate at elevation 17.5. When the reservoir pool reaches elevation 18.0, the gate will begin to open and become fully open when the reservoir pool reaches 18.5. When the pool reaches 18.6, flows will pass through the emergency spillway. Three 36-inch sluice gates with invert elevations at 0.0 can be operated to withdraw the water from reservoir above the dam.

4.2 Maintenance: A regular maintenance operation program, including adding copper sulfate as needed, cutting brush and greasing valves, has been developed by the City of Newport News, Virginia.

4.3 Warning System: A warning system is under development. Telephone numbers of local people and concerned agencies will be listed so that the filtration plant operator can contact these people during an emergency.

4.4 Evaluation: The dam does not require a more elaborate operational and maintenance procedure. The regular maintenance operation program should be documented for future reference.

SECTION 5
HYDRAULIC/HYDROLOGIC DESIGN

5.1 Design: None were available.

5.2 Hydrologic Records: Daily rainfall amounts and reservoir elevations are recorded at Lee Hall Filtration Plant.

5.3 Flood Experience: In June 1963 the dam was overtopped by 2-3 inches after 8 inches of rainfall in a two-day period.

5.4 Flood Potential: The PMF and 1/2 PMF were developed and routed through the reservoir by use of the HEC-1DB computer program (Reference 2, Appendix IV) and appropriate unit hydrograph, precipitation, and storage-outflow data. Clark's Tc and R coefficients for the local drainage area were estimated from basin characteristics. The rainfall applied to the developed unit hydrograph was obtained from the U. S. Weather Bureau Publication (Reference 3, Appendix IV). Losses were estimated at an initial loss of 1 inch and a constant loss thereafter of 0.05 inch/hour.

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1.

Regulated releases from the Lee Hall Reservoir furnish raw water to the Lee Hall Filtration Plant owned by the City of Newport News, Virginia. A 54-inch and a 24-inch reinforced concrete pipe can be used to draw water into the filtration system. The maximum withdrawal of water for filtration is 44 million gallons per day. Water automatically flows over the bascule gate in the event water in the reservoir above the dam rises above elevation 17.5. The gate will start to open automatically when the reservoir pool is at elevation 18.0 and will be fully open when the pool is at 18.5.

Area-capacity curves for the reservoirs above the Chesapeake and Ohio Railroad embankment and below it were developed from data provided by the owner and the use of a USGS Quadrangle Map. Pool levels above and below the embankment are never the same. Flows were routed through the railroad embankment, combined with inflows in the lower reservoir and then routed through the Lee Hall Reservoir Dam.

Rating curves for the top and culvert of the railroad embankment, bascule gate, emergency spillway, and non-overflow section of the dam were developed. In routing hydrographs through the reservoirs, it was assumed that the initial pool level was at elevation 20.0 above the railroad embankment and elevation 17.5 above the dam.

5.6 Overtopping Potential: The probable rise in the reservoir and other pertinent information on reservoir performance is shown in the following table:

Table 5.1 DAM AND RAILROAD EMBANKMENT PERFORMANCE

DAM PERFORMANCE

Item	Normal Flow	Hydrograph 1/2 PMF	Hydrograph PMF 1/
Peak flow, c.f.s.			
Inflow 2/	15	6376	11483
Outflow	15	5531	10981
Maximum elevation ft, msl	17.5	20.57	21.86
Non-overflow section (el. 21.0)			
Depth of flow, ft.	--	—	0.86
Duration, hrs	—	--	3
Velocity, f.p.s.3/	--	--	4.2
Tailwater elevation ft., msl	0.4±	—	--

RAILROAD EMBANKMENT PERFORMANCE

Item	Normal Flow	Hydrograph 1/2 PMF	Hydrograph PMF 1/
Peak flow, c.f.s.			
Inflow	14	14721	29442
Outflow	14	2701	5597
Maximum elevation ft, msl	20.0	30.7	37.0
Top of Embankment (el. 36.0)			
Depth of flow, ft.	--	--	1.0
Duration, hrs	—		12.0
Velocity, f.p.s.3/	--		4.5
Tailwater elevation ft., msl	17.5	18.7	20.5

1/ The PMF is an estimate of flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.
2/ Inflow reduced by storage above railroad embankment.
3/ Critical Velocities

5.7 Reservoir Emptying Potential: Three 36-inch sluice gates are available for dewatering the reservoir below the railroad embankment to elevation 0.0. The low level opening through the dam will permit withdrawal of about 410 cfs with the reservoir level at the top of the bascule gate and essentially dewater the reservoir in about 2 days assuming no inflow from the reservoir above the railroad embankment. This is equivalent to an approximate drawdown rate of 8.8 feet per day based on the hydraulic height measured from normal pool divided by the time to dewater the reservoir.

5.8 Evaluation: Based on the size (intermediate) and hazard classification (significant), the recommended Spillway Design Flood (SDF) appropriate to this dam is 1/2 PMF to the PMF. Because of the risk involved in this project, 1/2 PMF has been selected as the SDF. The bascule gate and the emergency spillway will pass 57 percent of the PMF without overtopping the dam.

The railroad culvert will pass 94 percent of the PMF without overtopping the railroad embankment.

Conclusions pertain to present day conditions. The effect of future development on the hydrology has not been considered.

SECTION 6

DAM STABILITY

6.1 Foundation and Abutments: There is no information available on the foundation conditions. The dam is located in the coastal plain geologic region of Virginia. The predominate deposit in the area is the Pleistocene Age Norfolk Formation. Based on the visual inspection, it is suspected that the dam has no drainage system. It is unknown how the dam is keyed into the foundation. The predominate foundation materials are relatively impervious, stable, fine grained marine deposits.

6.2 Embankment:

6.2.1 Material: There is no information available on the nature of the embankment materials. According to the history of the structure the embankment was raised to its present elevation in five stages since its construction in 1893. The dam was raised to its present height in the 1920's. Portions of the downstream slope were built up with dumped random fill taken from the nearby construction of the filtration plant in 1968, to buttress the embankment. The fill consisted of silty, fine sands. The area soils are generally low plastic marine deposited silts, clays, and fine sands.

6.2.2 Stability: There are no available stability calculations. The dam is 21 feet high and has a width ranging from 40 feet to 200 feet with a typical width of 50 feet. The upstream slope also varies, ranging from a minimum 2.5H:1V to a maximum 4H:1V. The downstream slope is highly irregular due to the dumped random fill. The steepest original downstream slope is 2H:1V. The dam is subjected to a sudden drawdown because the approximate reservoir drawdown rate of 8.8 feet per day exceeds the critical rate of 0.5 feet per day for earth dams. The existing pool is at maximum storage pool. According to the guidelines presented in Design of Small Dams, U. S. Department of the Interior, Bureau of Reclamation for small homogeneous dams, with a stable foundation, subjected to a drawdown, and composed of low plastic fines (CL, ML) the recommended slopes are 4H:1V upstream and 2.5H:1V downstream. The recommended width is 15 feet. Based on these guidelines, the dam has a width more than 2.5 times the recommended width. However, the steepest upstream and downstream slopes are considered to be inadequate.

6.2.3 Seismic Stability: The dam is located in Seismic Zone 1. Therefore, according to the Recommended Guidelines for Safety Inspection of Dams, the dam is considered to have no hazard from earthquakes provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: There is insufficient information to adequately evaluate the stability of the dam. However, the visual inspection revealed no apparent instability. Based on the visual inspection, the foundation is considered sound. The embankment is considered stable during normal pool operations due to its massive width despite portions of the embankment with possible inadequate slopes. Also, the embankment is considered stable during maximum storage pool operations because it exists at maximum pool. In addition, overtopping is not a problem because the spillways pass the design flood. Stability calculations are not required, because of past performance apparent by the visual inspecton and the stabilizing effect of the massive width.

SECTION 7

ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The available engineering data is inadequate. The visual inspection revealed no findings that proved the dam to be unsound during maximum storage pool operations. There is a regular maintenance operation program. Also, there is an adequate emergency operation and warning plan. Overall, the dam is in good condition and there is no immediate need for remedial measures. Corps guideline indicate the appropriate Spillway Design Flood (SDF) for an intermediate size and significant hazard dam is the 1/2 PMF. The bascule gate and the emergency spillway will pass 57 percent of the PMF without overtopping the dam; therefore, the combined spillways capacity is adjudged adequate. There are no overtopping flows during the SDF and, therefore, not considered detrimental to the embankment. A stability check of the dam is not required.

7.2 Recommended Remedial Measures: It is recommended that the existing maintenance operation program be documented for future reference. Also, the inspection revealed the following maintenance items that should be scheduled by the owner during a regular maintenance period within the next 12 months.

a. The trees located on the crest, on the downstream slope between Stations 0+00 and 12+50 noted on Plate VIII of Appendix I, and the tree located adjacent to the gate spillway approach channel should be cut down and have the root structures removed. The subsequent holes should be regraded, dressed with compacted fill, and seeded. The trees located in the discharge channels of both the gate and emergency spillways should be cut to the trunk. The removal of trees from the embankment and spillways is necessary to prevent further growth and reduce chances of piping.

b. The gully noted at STA 12+50 should be regraded, dressed with compacted fill, and seeded.

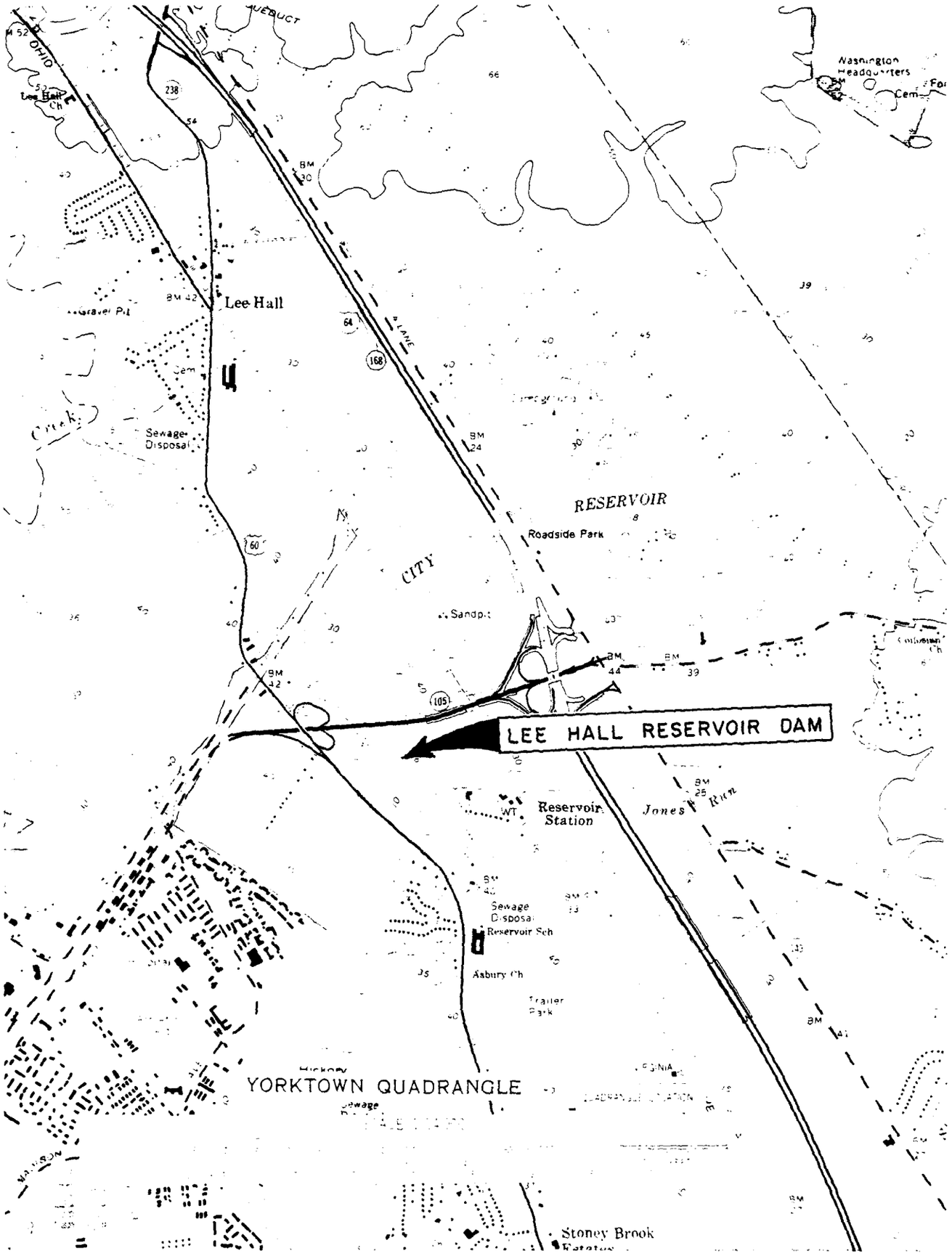
c. The cracks and seeps noted in the emergency spillway should be periodically monitored and repaired if further deterioration is evident and threatens the integrity of the structure.

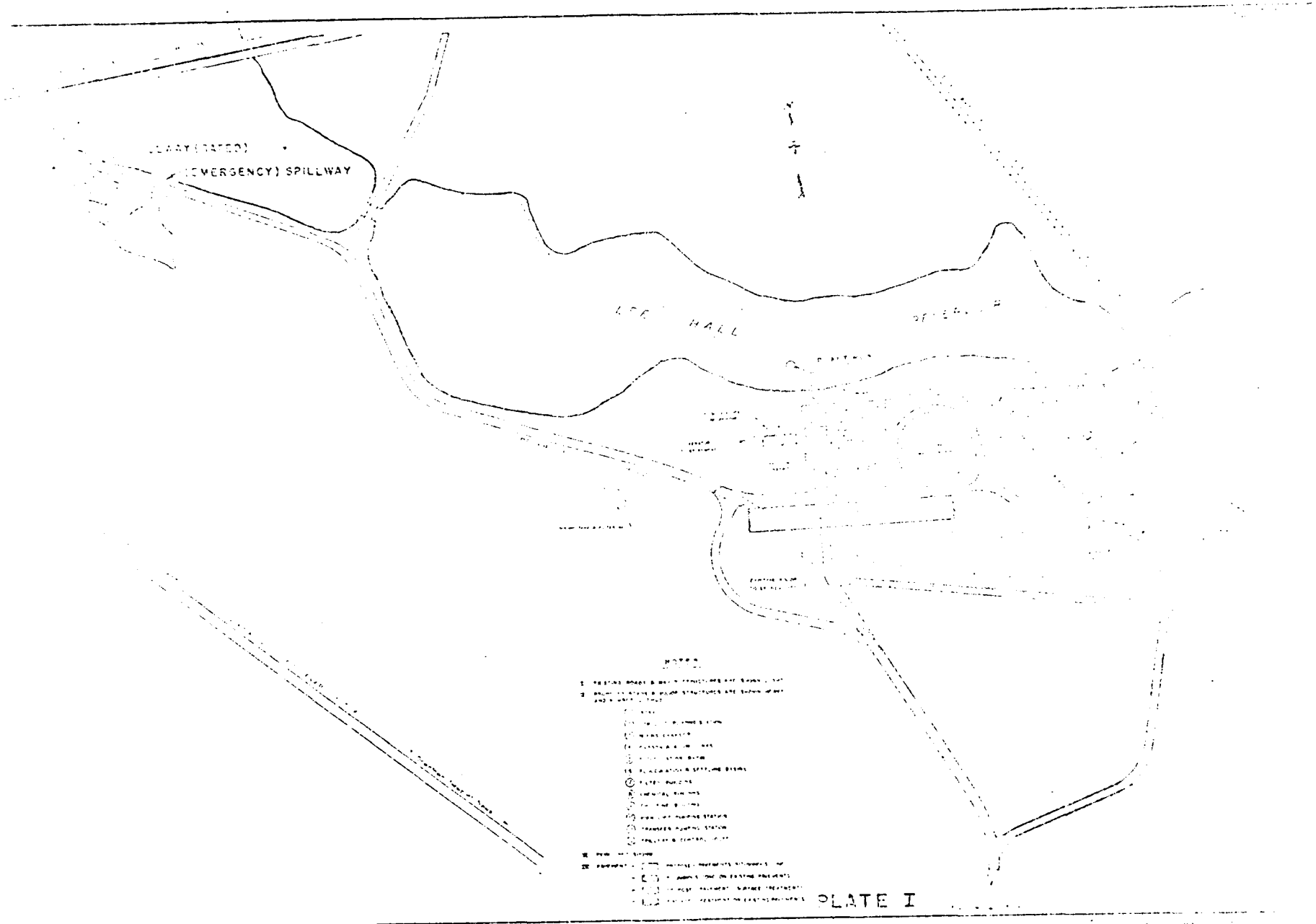
d. The downstream slope of the embankment where it was built up adjacent to the emergency spillway should be monitored during maximum pools for seeps. The concrete pavement with the embankment could encourage cracking and possible piping.

e. The city should attempt to reinstate the operability of the bascale gate to their satisfaction.

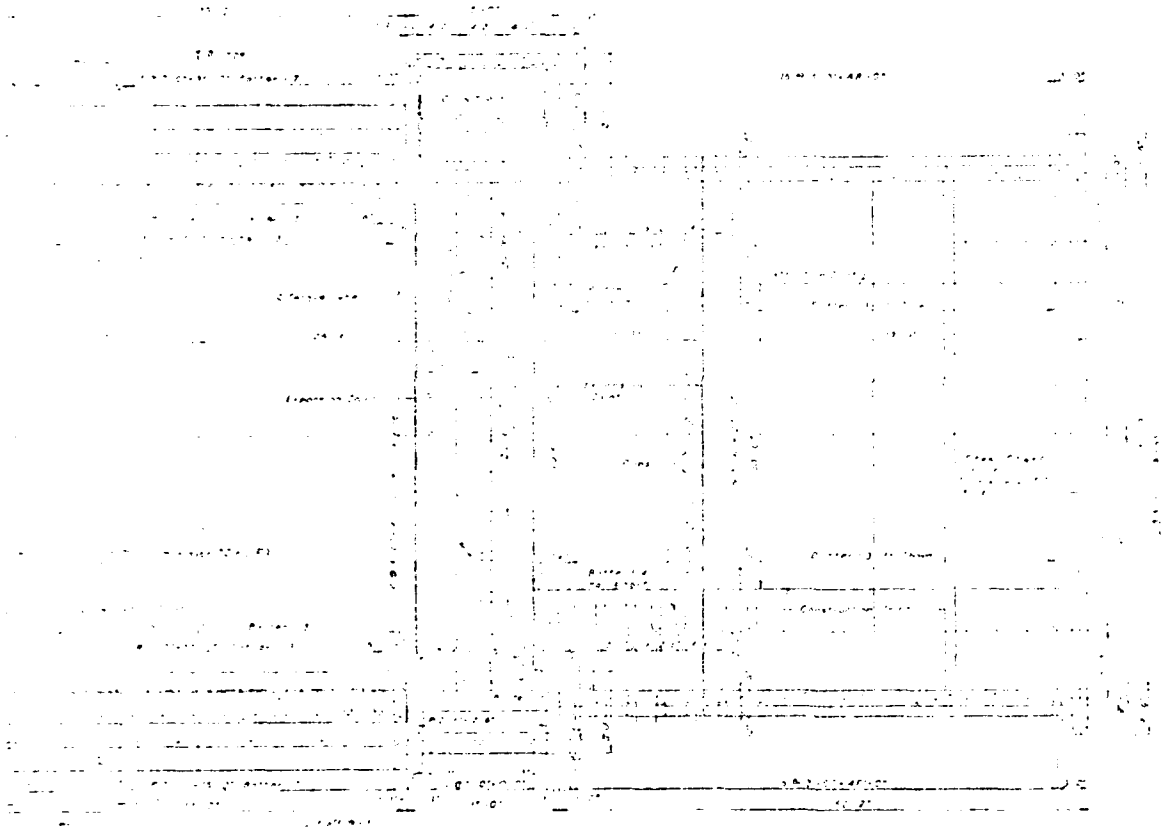
APPENDIX I

MAPS AND DRAWINGS


Lee Hall
RESERVOIR
Roadside Park
LEE HALL RESERVOIR DAM
Reservoir Station
Jones Run
Sewage Disposal
Reservoir Sch
Asbury Ch
Trailer Park
Stoney Brook
YORKTOWN QUADRANGLE
Washington Headquarters
Sandpit
Gravel Pit
Creek
238
64
168
60
105


(EMERGENCY) SPILLWAY
LEE HALL
PLATE I

NOTE: DRAWINGS DO NOT REFLECT ACTUAL FIELD CONDITIONS NOTED DURING
NPID FIELD INSPECTION ON NOV 23,1970. CONCRETE BRIDGE IS NOT
IN PLACE AND 42-INCH ABOVE GROUND WATER LINE SPRINGS NOTED
AND EMERGENCY SPILLWAYS IS NOT SHOWN ON THIS PLATE.



PILE PLAN

SCALE

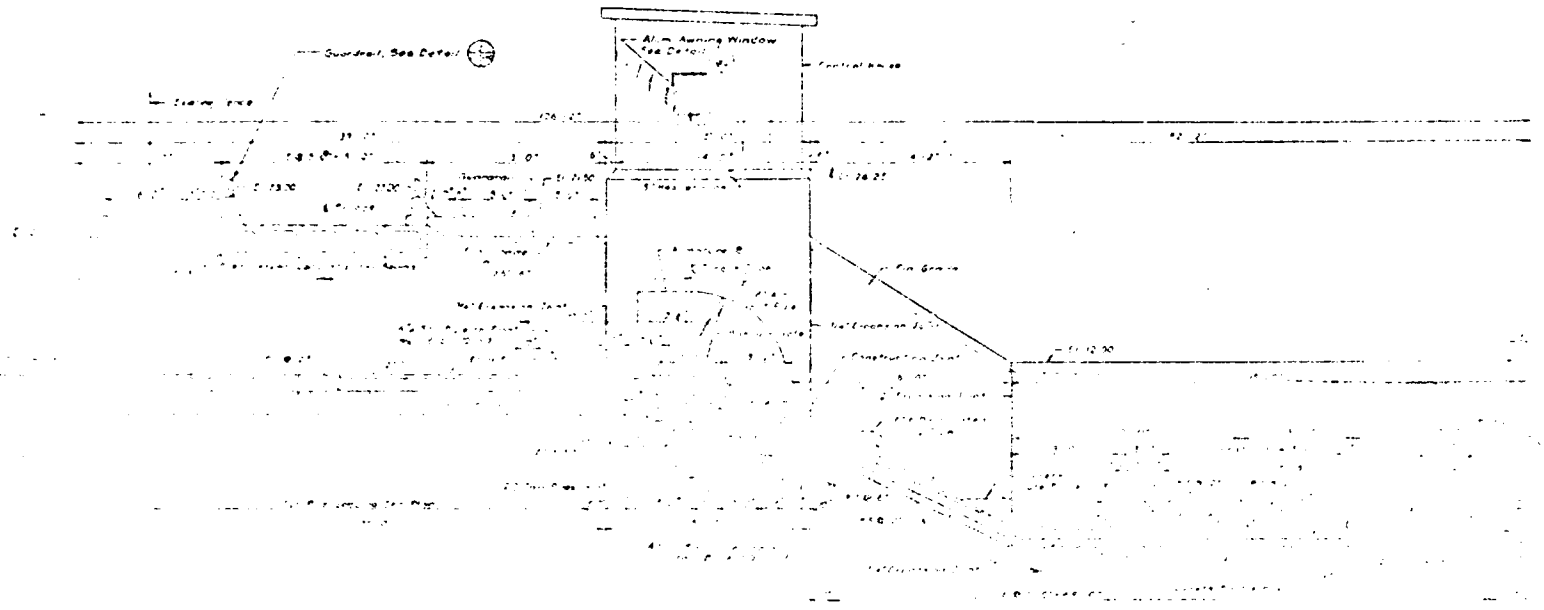
GENERAL PLAN

HALF SCALE

PLATE II

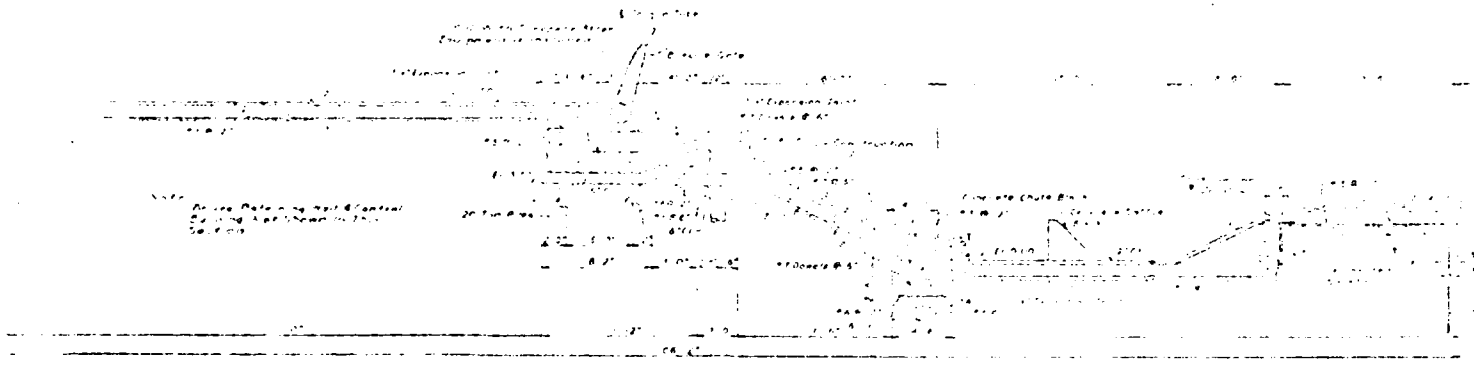
CITY OF NEWPORT, KNOX COUNTY, KENTUCKY
DEPARTMENT OF PUBLIC UTILITIES
WATER SYSTEM IMPROVEMENTS

PROPOSED



SECTION

REFLECT ACTUAL FIELD CONDITIONS NOTED DURING
ON NOV 28 1939 CONCRETE BRIDGE IS NOT
ABOVE STILLED WATER LINE SPANNING GATED
IS NOT SHOWN ON THIS PLATE.



SECTION

HALF

PLATE III

CITY OF LAWRENCE, KANSAS
DEPARTMENT OF PUBLIC UTILITIES

PROPOSED SPILLWAY

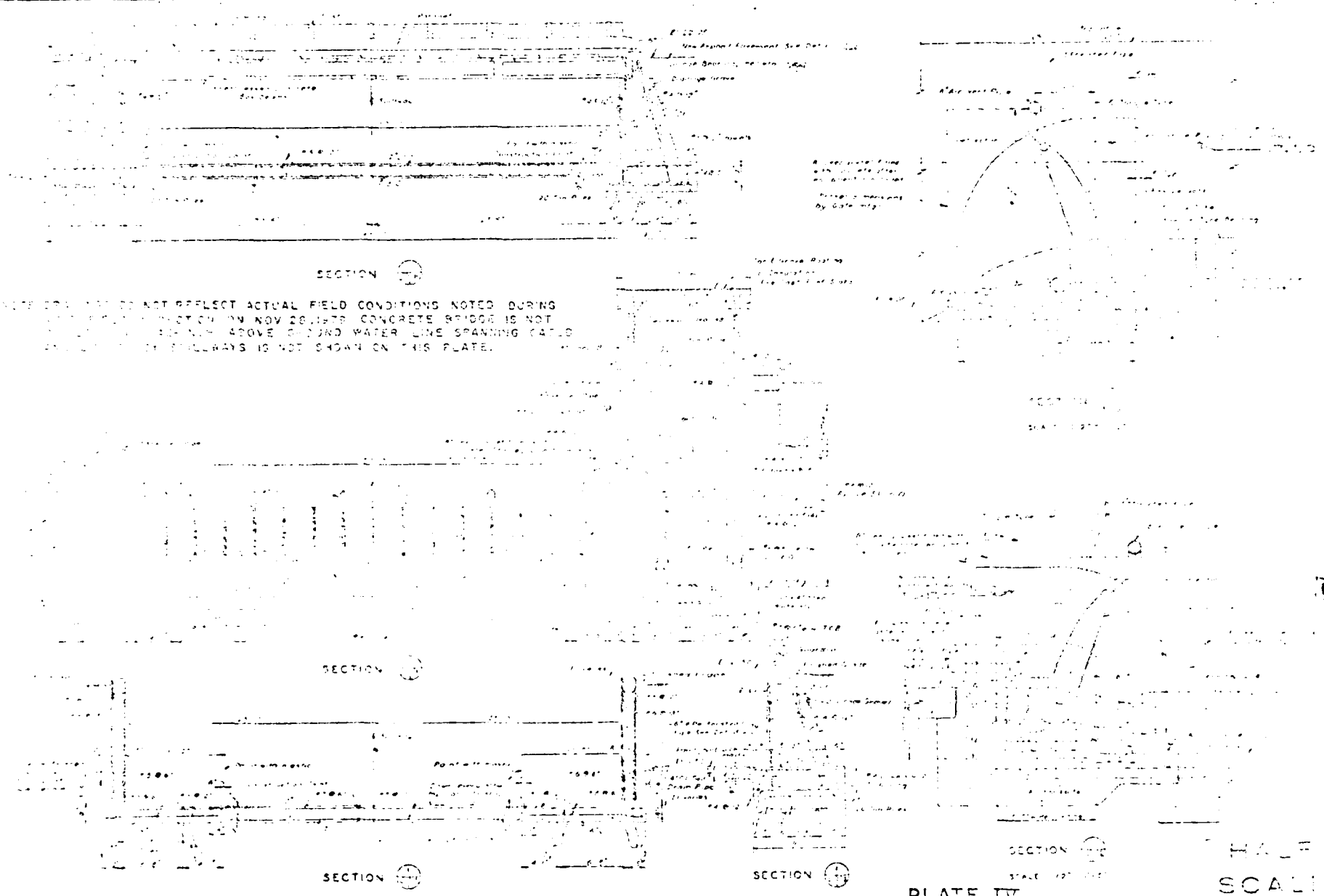
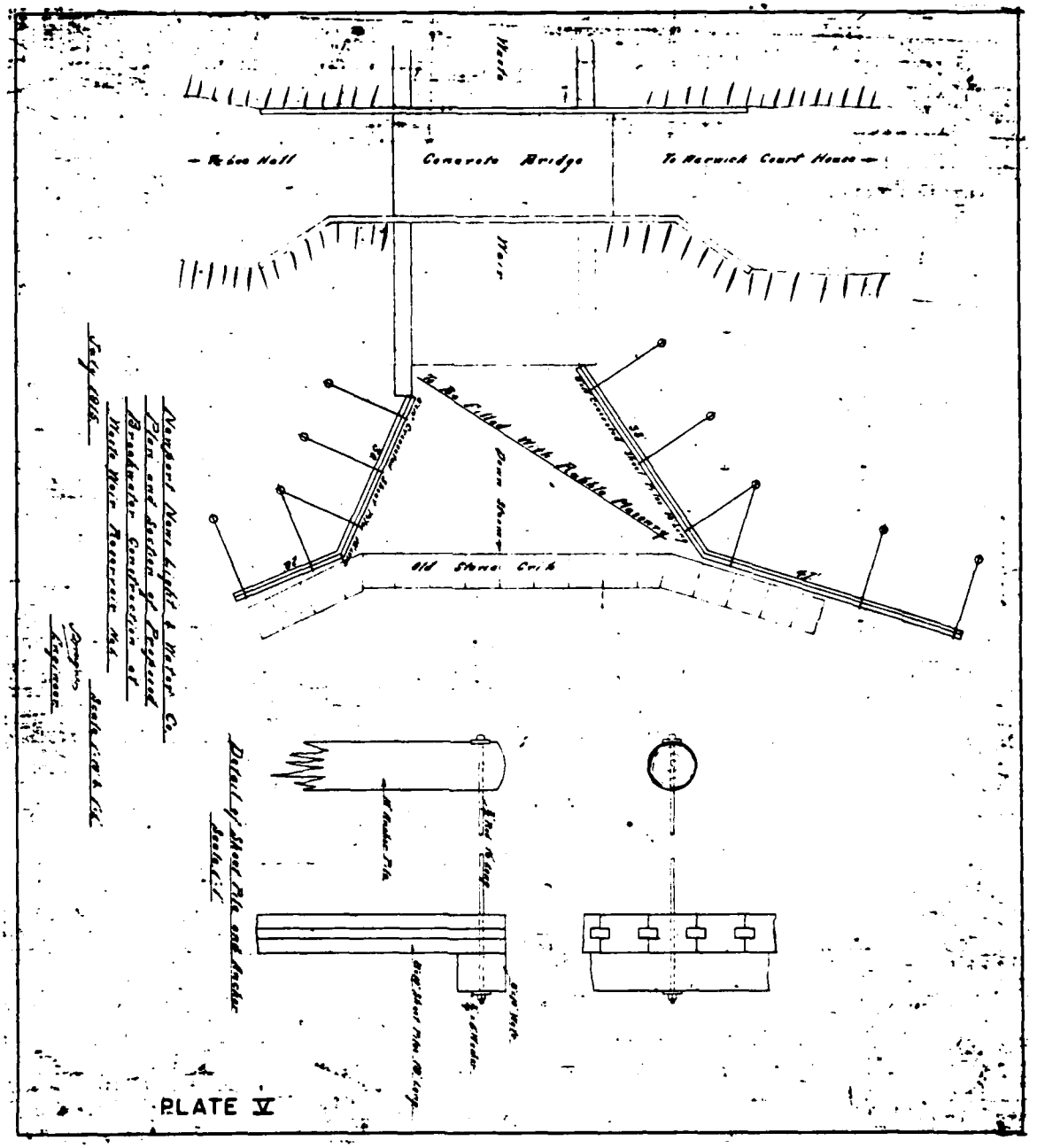


PLATE IV

CITY OF NEWPORT NEWS, VIRGINIA
DEPARTMENT OF PUBLIC UTILITIES
WATER SYSTEM IMPROVEMENTS

PROPOSED SPILLWAY
SECTIONS



Newport Power Light & Water Co.
Plan and Section of Proposed
Breakwater Construction at
Main Weir Reservoir No 4
Scale 1/16" = 1'-0"

Scale 1/16" = 1'-0"

Designed
Engineer

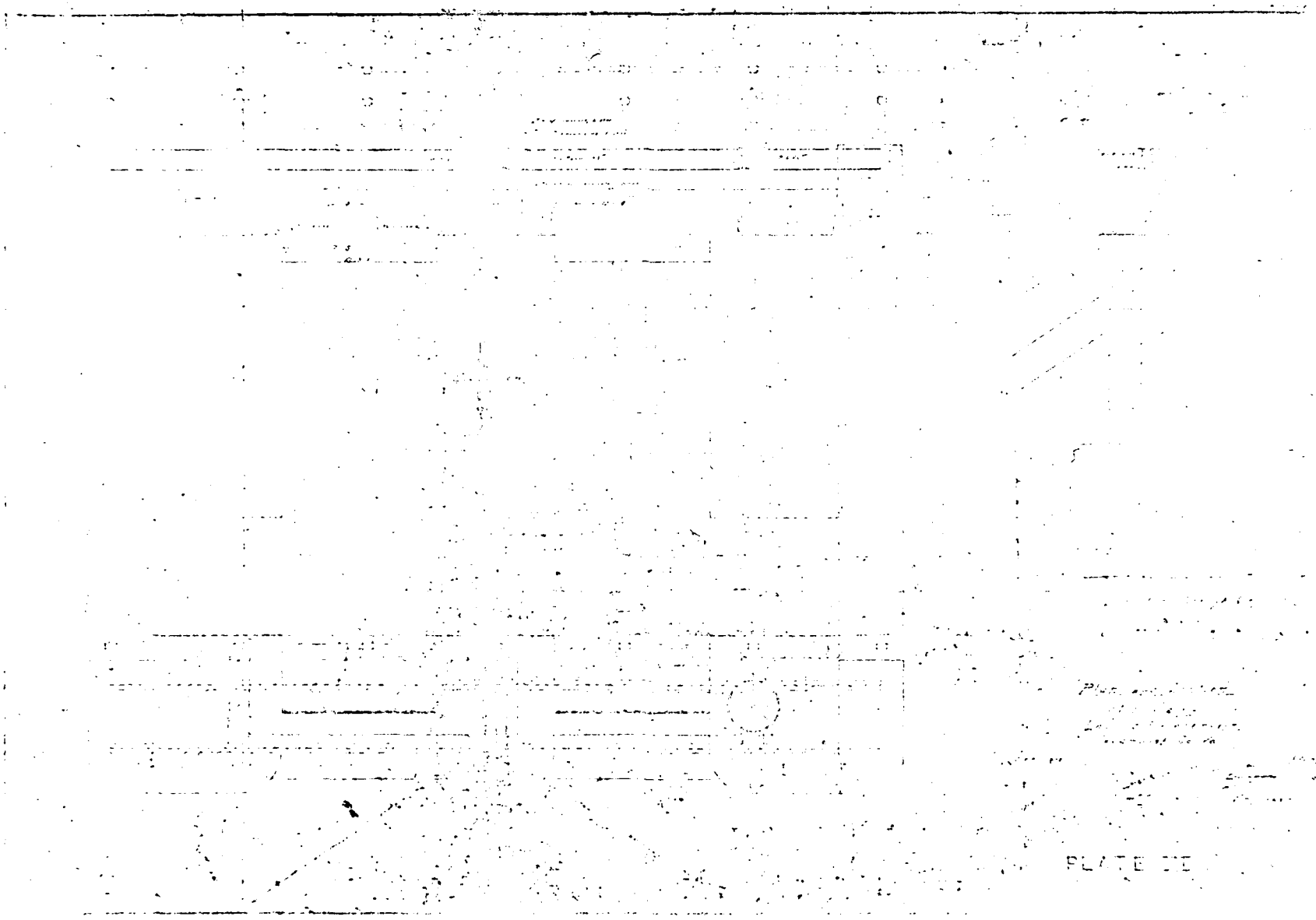


PLATE III

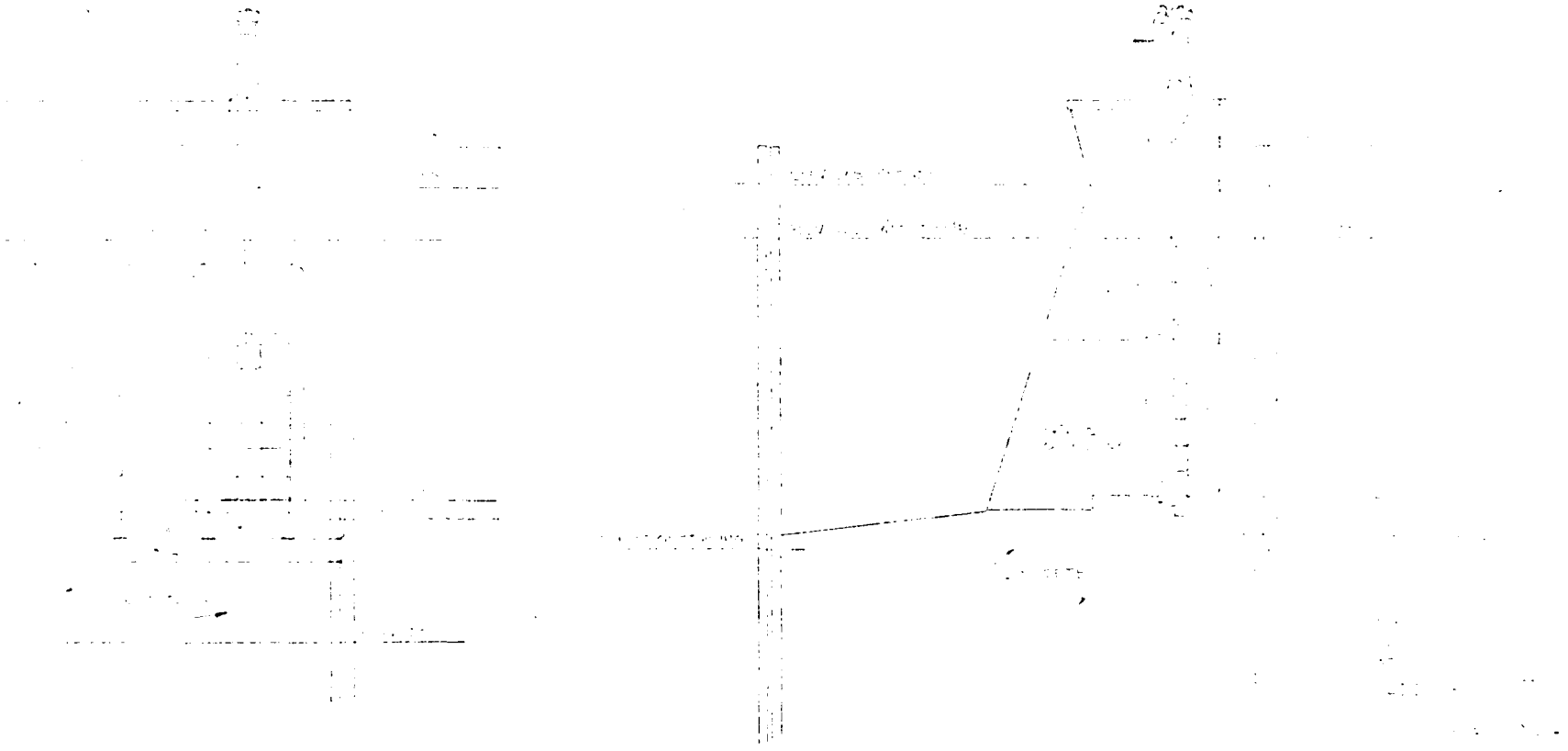


PLATE XIII

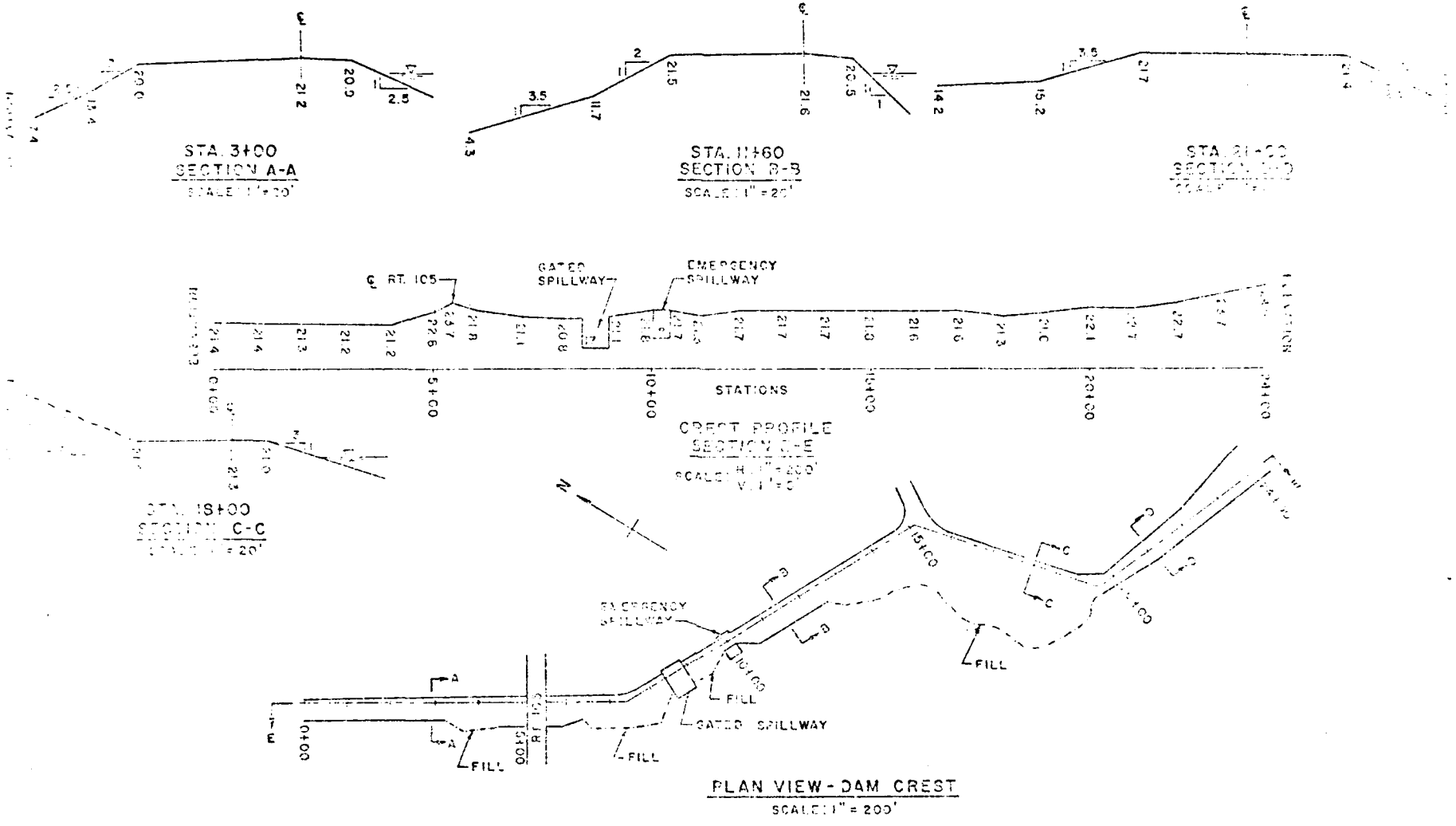


PLATE XXI

LEE HALL RESERVOIR
CITY OF NEWPORT NEWS, VA.
DECEMBER 1979

APPENDIX II

PHOTOGRAPHS

PHOTO #1: PARTIAL VIEW OF DAM AND PRINCIPAL SPILLWAY

PHOTO #2: TYPICAL OF GROWTH ON DOWNSTREAM EMBANKMENT

PHOTO* 3: VIEW OF PRIMARY SPILLWAY AND BASCULE GATE

PHOTO* 4: BASCULE GATE

PHOTO #5 : EMERGENCY SPILLWAY & RESERVOIR DRAIN OPERATORS

PHOTO #6: DOWNSTREAM SIDE OF EMERGENCY AND RESERVOIR DRAIN OUTLET

PHOTO # 7: LEAK IN RT. ABUTMENT OF MASONARY EMERGENCY SPILLWAY

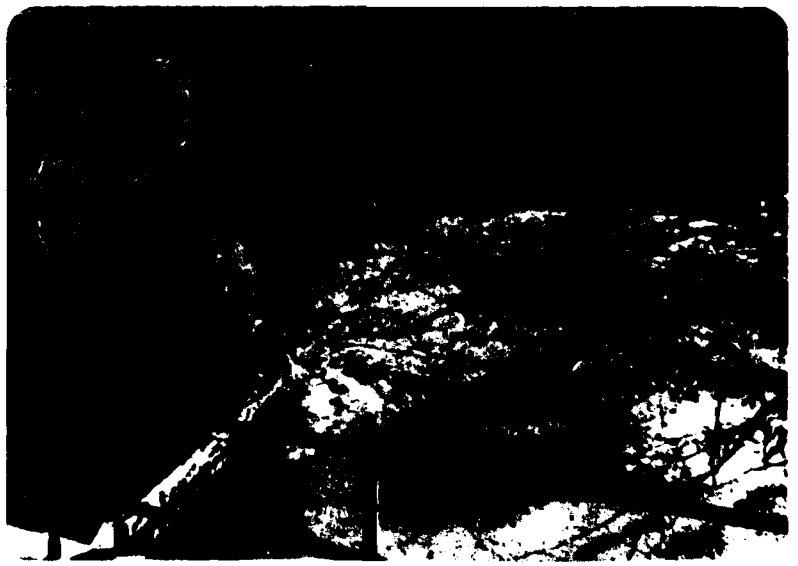


PHOTO # 8: EMERGENCY SPILLWAY DISCHARGE CHANNEL (SUBJECT TO TIDAL ACTION)

APPENDIX III

FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Dam: City of Newport News Lee Hall Reservoir City: Newport News State: Virginia Coordinators: Lat 37° 10.3' Long 76° 33.8'

Dates of Inspection:	Weather:	Temperature:
28 Nov 79	Sunny & Clear	74° F.
30 Nov 79	Overcast	35° F.
10 Dec 79	Sunny & Clear	45° F.

Pool Elevation at Time of Inspection: 17.3 M.S.L. Tailwater at Time of Inspection: 0.4 M.S.L.

Inspection Personnel:

L. Jones, COE
M. Byrne, COE
J. Robinson, COE
B. Taran, COE
D. Pezza, COE
L. Musselwhite, SWCB
D. Bushman, SWCB
S. McGhee, City
E. Lett, City
C. Crowder, City
J. Hautz, City
B. Bradish, City
F. Brown, City (10 Dec 79)
S. Walden, City (10 Dec 79)

Pezza & Robinson Recorders

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	No surface cracks were found. Downstream slopes are heavily vegetated with up to 18 inch diameter trees. Parts of the downstream embankment were built up with fill. Fill areas are located on Plate VIII. The crest and upstream slope are kept trimmed. A few small pines are located on the upstream crest between STA 16+00 and 21+00.	Trees located on the crest and on the downstream slope in the area noted on Plate VIII should be cut down and have the root structures removed. Subsequent holes should be regraded, dressed with compacted fill, and seeded.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No unusual movement or cracking was noted at or beyond the toe. The area downstream of the spillways is a tidal swamp.	None.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	There are several gullies caused by surface runoff located on the downstream slope of the massive fill between STA 12+50 and 19+60. Also there is a gully at the junction of the fill and original embankment at approximately STA 12+50.	The gully at STA 12+50 should be regraded, dressed with compacted fill, and seeded.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The alignment of the dam does not show any signs of movement. The crest serves as a road. The road consists of a few inches of gravel overlaying a 20 foot wide concrete pavement that once served as Route 60. In the area approaching the emergency spillway from each direction, the pavement slopes down and the embankment was built up 3 to 4 feet to level the crest. This built up area was eroded away to the top of the pavement during the 1963 storm. The pavement prevented further erosion. It is unknown why there was the 3 to 4 foot differential in elevation.	The downstream slope of the embankment where it was built up adjacent to the emergency spillway should be monitored during maximum pools for seeps. The concrete pavement within the embankment could encourage cracking and possible piping.

EMBANKMENT (Cont.)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
RIPRAP FAILURES	The upstream slope is protected with dumped concrete rubble. In some areas the rubble has thinned out. The slopes are not subjected to waves or fluctuating pools and there are no signs of slope erosion.	None.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No erosion, sloughing, or seepage was noted at dam junctions.	None.
ANY NOTICEABLE SEEPAGE	No seepage was found.	None.
DRAINS	There are no known drains in the dam. No signs of seepage were found on the downstream slope.	None.

EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	There is minor cracking on the crest of the spillway. Overall it is in good condition. An existing concrete overhang will inhibit weir flows and should develop pressure flows.	None.
APPROACH CHANNEL	The channel is concrete lined with some cracking. Overall it is in good condition.	None.
DISCHARGE CHANNEL	There are five seeps from the face of the masonry weir spillway face. The seeps are clearly visible and easy to locate in the field. There is a boil on the centerline of the discharge apron about 5 feet from the downstream edge. A tree is growing out of the left wing wall. Overall, the channel is in good condition.	Cut the tree down to the trunk. Vegetative growth should not be allowed to grow in the channel. Monitor the seeps during periodic inspections and repair if further deterioration is evident. If possible, monitor during flood conditions.
BRIDGE AND PIERS	The concrete structural slab bridge inhibits flow through the weir. The slab has a longitudinal crack across the entire upstream face.	Monitor the crack during periodic inspections and repair if further deterioration is evident.
EMERGENCY GATES	The three 36-inch diameter sluice gates appear rusted. Two gates are operable. The left gate is partially operable.	None.

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
BASCULE GATE, OPERATION AND EQUIPMENT	The gate is in good condition. Gate seals abutting the concrete wing walls have deteriorated. There is minor leakage. The gate is at an 80° angle. The gate operates automatically and is hydraulically activated by a float system.	The City is not satisfied with the past performance of the gate. The City can open the gate but they are not sure the gate can be closed. Allis-Chalmers, the gate manufacturer, recently checked the gate but the City is still dissatisfied with the performance of the gate.
APPROACH CHANNEL	The channel is concrete lined with minor cracking. There is no debris in the channel. There is a tree growing adjacent to the upstream right wing wall of the channel near the gate. Overall the channel is in good condition.	Cut the tree down and remove the root structure. Subsequent holes should be regraded, dressed with compacted fill, and seeded.
DISCHARGE CHANNEL	The stilling basin is concrete lined with eleven dissipator blocks. Riprap lines the downstream edge of the basin to protect the downstream area. Small trees are growing in the riprap. The channel is in good condition.	Cut the trees down to the trunk.
WATERLINE	A 42 inch diameter water supply line passes over the spillway and provides water to the Anheuser Busch Brewery.	None.

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	There are two VDH&T concrete right of way monuments located on the dam as shown on PLATE VIII.	None.
OBSERVATION WELLS	There are capped open stand pipes in the reservoir area near the filtration plant to monitor seepage from nearby lagoons.	None.
WEIRS	None other than the emergency spillway.	None.
PIEZOMETERS	There are no embankment or foundation piezometers.	None.
OTHER	There is no other type instrumentation on the dam.	None.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The surrounding terrain is relatively flat and heavily wooded. There are no signs of reservoir slope failures or shoreline erosion. There are several bridges in the reservoir that effect the efficiency of the reservoir. The bridges increase the storage potential by creating a damming effect.	None.
SEDIMENTATION	There is no information pertaining to sedimentation.	None.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The area below the spillway outlets is tidal and flushed daily. The immediate downstream area is flat and wide. About 200 yards downstream there is a hill that channels the flow beneath Route 60. Beyond Route 60 the floodplain opens up into a broad flat marshland.	None.
SLOPES	The area is relatively flat with marshlike vegetation.	None.
APPROXIMATE NO. OF HOMES AND POPULATION	There are 6-8 homes in the flood plain less than one mile below the dam.	None.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	There is no plan of the dam other than a general design site plan provided on Sheet 1 of Contract No. 4, Additions to Lee Hall Filtration Plants & Other Works.
REGIONAL VICINITY MAP	The dam is shown on the Yorktown USGS Quadrangle map.
CONSTRUCTION HISTORY	A brief written summary of the history was provided by City officials.
TYPICAL SECTIONS OF DAM	There are no sections of the dam.
HYDROLOGIC/HYDRAULIC DATA	There are no hydrologic and hydraulic data other than rainfall & pool records.
OUTLETS - PLAN	Profile sections are available for the emergency gates. There are no known constraints or discharge ratings.
RAINFALL/RESERVOIR RECORDS	Daily raingage data and pool elevations are available.
DESIGN REPORTS	There are no known design reports.
GEOLOGY REPORTS	There are no known geology reports.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DATA DAM STABILITY SEEPAGE STUDIES	There are no known design computations, dam stability analyses, and seepage studies. The only hydrology & hydraulic data, are the reservoir capacity curve data designated a spillway capacity curve.

ITEM	REMARKS
POST-CONSTRUCTION SURVEYS OF DAM	There are no known post construction survey records of the dam.
MATERIAL INVESTIGATIONS BORING RECORDS LABORATORY TEST RESULTS FIELD TEST RESULTS	There are no known material investigation records, boring records, laboratory test records, or field test records.
BORROW SOURCES	There are no known past records pertaining to borrow sources. The fill material dumped on the downstream portion of the dam is shown on PLATE . The material came from the excavation of the nearby filtration plant settling basin in 1968.
SPILLWAY PLAN SECTIONS DETAILS	There are design sections and details provided in the Contract No. 4. Additions to Lee Hall Filtration Plant and other structures. However, drawings show a bridge across the spillway, that was never built.
OPERATING EQUIPMENT PLANS & DETAILS	There is an operations manual for the Bascule Gate. The City will provide a description of the operation of the spillway and downstream filtration plant in relation to the dam.
MONITORING SYSTEMS	Other than a staff gage and raingage at the filtration plant, the Bascule Gate is automatically activated by a float system to regulate pool levels.
MODIFICATIONS	Spillway capacity was increased in 1968 by adding the Bascule gate.
HIGH POOL RECORDS	The dam was overtopped by 1 to 2 inches at the lower elevations in June 1963.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	There are no known post construction engineering studies and reports.

ITEM	REMARKS
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	The dam was overtopped at several different points during the June 1963 storm. There are no written reports. Visual accounts noted that damage was limited to erosion of the embankment.
MAINTENANCE OPERATION RECORDS	The only records are staffgage and raingage readings.

APPENDIX IV

REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Office of the Chief of Engineers, Department of the Army, Washington, D. C.

2. HEC-1DB Flood Hydrograph Package, (Hydrologic Engineering Center, U. S. Army Corps of Engineers, September 1978.)

3. "Probable Maximum Precipitation Estimates, United States East of the 105th Meridian," Hydrometeorological Report No. 51, (U. S. Weather Bureau, June 1978).